Bull. Southern California Acad. Sci.
113(3), 2014, pp. 176–179

Male Mating Posture and Courtship Coloration of the Temperate Marine Tubesnout, *Aulorhynchus flavidus* (Gill)

Michael J. Schram and Larry G. Allen

Department of Biology, 18111 Nordhoff Street, California State University, Northridge, California 91330–8303

Species that engage in sexual reproduction often exhibit dynamic physical features and behavioral actions that serve to signal conspecifics. Body posture, vocalizations or the incorporation of bright coloration are typically used to establish dominance (Wiley 1973, Warner 1975, Clarke and Faulkes 1997, Peterson and Jacobs 2002) alert conspecifics of nearby threats or foraging opportunities (Godin and Morgan 1985, Beauchamp and Heeb 2001, Le Roux et al. 2009, Townsend et al. 2011) and for breeding purposes (Wiley 1973, Hagen et al. 1980, Christy 1983, Gibson 1989, DeMartini and Sikkel 2006). In many species females select a male based on their behavioral display of some desirable trait or their ability to express dominance or competitive superiority over other potential mates (DeMartini and Sikkel 2006). Such criteria are often not mutually exclusive in that particular features or actions may act to deter competitor males while simultaneously attracting females (Hagen et al. 1980, Cairns 1982). Understanding such physical characteristics or behavioral signals improves our knowledge of reproductive systems within and among taxonomic groups.

Reproductive strategies have been well documented in the marine realm, including monogamous pairs (Whiteman and Côte 2004), large broadcast breeding aggregations (Coleman et al. 1996, Colin 1996, Carolsfeld et al. 1997), sneak copulation (Pilastro and Bisazza 1999, Hurtado-Gonzales and Uy 2010) and nesting species (Limbaugh 1964, Wiley 1973). Limbaugh (1962) previously described the nesting habitat for the temperate marine tubesnout, *Aulorhynchus flavidus* (Gill), but male mating behavior has not been characterized. A proposed description of male mating behavior is reported here from observations of *A. flavidus* on display at the Aquarium of the Pacific (AOP) in Long Beach, California during early May, 2013.

Male *A. flavidus* pelvic fins are red in color (Fig. 1A) and are thought to remain that way year round (Love 2011). The heads of males are also dark blue to black with a prominent iridescent blue patch on their snout (Fig. 1B). Iridescent blue spots/coloration have also been observed along the full body length of males (Love 2011) while females are a drab brownish color throughout (Fig. 2). Although typically found at depths of 20 m, and as deep as 37 m (Love 2011), the preferred nesting habitat of *A. flavidus* is the upper blades of the macrophyte *Macrocystis pyrifera*. While bright coloration is common to tropical waters, it is disfavored in temperate marine habitats due to low light penetration at depth. The conspicuous coloration of males may be apparent only when actively breeding in the upper water column where red light is still present. It appears the pelvic fins are often folded up against the body (Fig. 1B) and covered partially by the pectoral fins when they are not actively displaying them. The anterior underside of male threespine stickleback (*Gasterosteus aculeatus*), another gasteriform species, are also red (Hagen et al. 1980) and both species breed in shallower water than they are typically found (~20–30 m depth). Similarities in external morphology despite differences in breeding habits

Fig. 1. A) During courtship male *A. flavidus* position themselves in a declined (head-down) position facing a prospective female. They will flare their fins and undulate the pelvic fins back and forth in an alternating sequence against body. B) Male heads are dark blue to black with a prominent iridescent blue patch on the snout. C) When not actively courting males slightly retract the dorsal and anal fins and the pelvic fins are tucked up close against the body.

perhaps suggest red coloration developed in a shared ancestor and has persisted over evolutionary time despite counter-selective pressures in temperate waters.

Male *A. flavidus* at AOP were observed flaring their fins in a declined (head-down) position (Fig. 1A) facing a nearby female, an action interpreted as a courtship display.

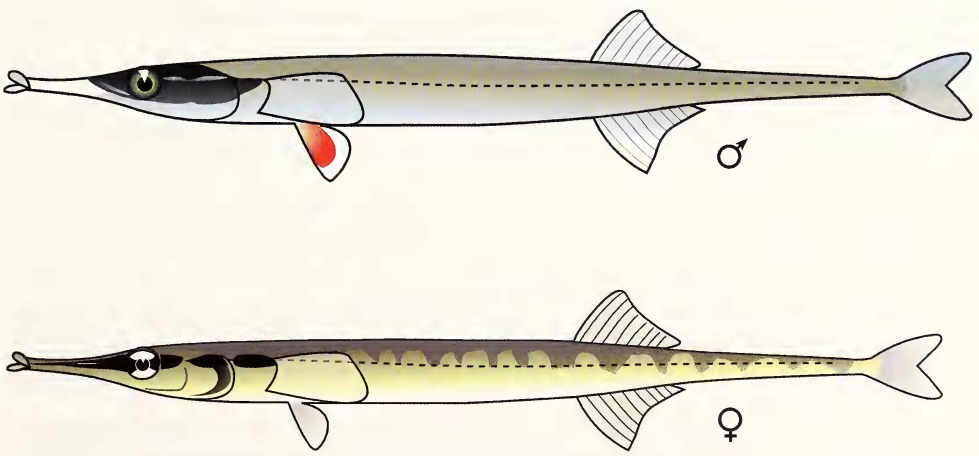

Fig. 2. Artist rendering of male (top) and female (bottom) *A. flavidus* body coloration. Notable differences between males and females are coloration along the length of the body, pelvic fins and the head. (Image by Larry G. Allen)

While maintaining this posture, they may undulate their fins lightly with accompanied full body undulations, a behavioral display common among other fishes (Limbaugh 1964, Wiley 1973, Steele and Anderson 2006). A similar posture was observed when conspecific males were present, but were typically followed by a chase to displace the competitor male, actions not taken toward females. Due to the similarity of these interactions, it is difficult to definitively determine whether this is a generic social interaction or whether a true courtship display. A lack of suitable nesting habitat (giant kelp fronds), due the nature of the display aquaria at AOP, might have precluded oviposition by females, although it is questionable whether female spawning response necessitates an established nest (Limbaugh 1962). While the results of this study may not provide a definitive description of male mating behavior, it does offer a cursory characterization of a previously undocumented aspect of the behavior of this species. Further behavioral studies focusing on conspecific interactions would elucidate subtle differences and may provide greater insight to the reproductive behavior of *A. flavidus*.

Literature Cited

Beauchamp, G. and P. Heeb. 2001. Social foraging and the evolution of white plumage. Evolutionary Ecology Research, 3:703–720.

Cairns, W.E. 1982. Biology and Behavior of Breeding Piping Plovers. The Wilson Bulletin, 94(4): 531–545.

Carolsfeld, J., M. Tester, H. Kreiberg, and N.M. Sherwood. 1997. Pheromone-Induced Spawning of Pacific Herring. Hormones and Behavior, 31:256–268.

Christy, J.H. 1983. Female Choice in the Resource-Defense Mating System of the Sand Fiddler Crab, *Uca pugilator*. Behavioral Ecology and Sociobiology, 12:169–180.

Clarke, F.M. and C.G. Faulkes. 1997. Dominance and queen succession in captive colonies of the eusocial naked mole-rat, *Heterocephalus glaber*. Proceedings of the Royal Society of London B., 264: 993–1000.

Coleman, F.C., C.C. Koenig, and L.A. Collins. 1996. Reproductive styles of shallow-water groups (Pisces: Serranidae) in the eastern Gulf of Mexico and the consequences of fishing spawning aggregations. Environmental Biology of Fishes, 47:129–141.

Colin, P.L. 1996. Longevity of Some Coral Reef Fish Spawning Aggregations. Copeia, 1996(1): 189–192.

DeMartini, E.E. and P.C. Sikkel. 2006. Reproduction. In: Allen, L.G., D.J. Pondella, and M.H. Horn, editors. The Ecology of Marine Fishes. California and Adjacent Waters. University of California Press, Berkeley and Los Angeles, California. University of California Press Ltd., London, England. Pp. 483–523.

Gibson, R.M. 1989. Field Playback of Male Display Attracts Females in Lek Breeding Sage Grouse. Behavioral Ecology and Sociobiology, 24:439–443.

Godin, J. and M.J. Morgan. 1985. Predator avoidance and school size in a cyprinodontid fish, the banded killifish (*Fundulus diaphanous* Lesueur). Behavioral Ecology and Sociobiology, 16:105–110.

Hagen, D.W., G.E.E. Moodie, and P.F. Moodie. 1980. Polymorphism for Breeding Colors in Gasterosteus aculeatus II. Reproductive success as a Result of Convergence for Threat Display. Evolution, 34(6): 1050–1059.

Hurtado-Gonzales, J.L. and J.A.C. Uy. 2010. Intrasexual competition facilitates evolution of alternative mating strategies in a colour polymorphic fish. BMC Evolutionary Biology, 10:391–401.

Limbaugh, C. 1962. Life History and Ecological Notes on the Tubenose, *Aulorhynchus flavidus*, a Hemibranch fish of Western North America. Copeia, 1962(3): 549–555.

———. 1964. Notes on the Life History of Two Californian Pomacentrids: Garibaldis, *Hypsypops rubicunda* (Girard), and Blacksmiths *Chromis punctipinnis* (Cooper). Pacific Science, 28:41–50.

Love, M.S. 2011. Certainly more than you want to know about the fishes of the pacific coast. Santa Barbara California, Really Big Press. Pp. 208–209.

Peterson, R.O., A.K. Jacobs, T.D. Drummer, L.D. Mech, and D.W. Smith. 2002. Leadership behavior in relation to dominance and reproductive status in gray wolves, *Canis lupus*. Canadian Journal of Zoology, 80:1405–1412.

Pilastro, A. and A. Bisazza. 1999. Insemination efficiency of two alternative male mating tactics in the guppy *Poecilia reticulata*. Proceedings of the Royal Society of London B., 266:1887–1891.

Roux, A.L., M.I. Cherry, and M.B. Manser. 2009. The vocal repertoire in a solitary foraging carnivore, *Cynistic penicillata,* may reflect facultative sociality. Naturwissenschaften., 96:575–584.

Steele, M.A. and T.W. Anderson. 2006. Predation. In: Allen, L.G., D.J. Pondella, and M.H. Horn, editors. The Ecology of Marine Fishes. California and Adjacent Waters. University of California Press, Berkeley and Los Angeles, California. University of California Press Ltd., London, England. Pp. 428–448.

Townsend, S.W., M. Zöttl, and M.B. Manser. 2011. All Clear? Meerkats attend to contextual information in close calls to coordinate vigilance. Behavioral Ecology and Sociobiology., 65:927–1934.

Warner, R.R. 1975. The reproductive biology of the protogynous hermaphrodite *Pimelopton pulchrum* (pisces: labridae). Fisheries Bulletin, 73(2): 262–283.

Whiteman, E.A. and I.M. Côté. 2004. Monogamy in Marine Fishes. Biol. Rev., 79:351–375.

Wiley, J.W. 1973. Life history of the western north American goby, *Coryphoterus nicholsii* (bean). San Diego Soceity of Natural History, Transactions, 17(14): 187–208.